FINAL REPORT

for

DEFINITION OF THE SCIENCE REQUIREMENTS FOR SIRTF

Grant No. NAG 2-319

July 1, 1984 to September 30, 1990

August 21, 1991

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INTRODUCTION

This progress report summarizes work performed by the SIRTF Facility Scientist as a member of the SIRTF Science Working Group (SWG) during the period April 1, 1990 to Sept 30, 1990. Most of the detailed documentation of the work performed is in the form of SWG minutes and reports. Perhaps the most important of these reports is the Level One Requirements Document which serves as the repository of much of the combined knowledge and experience collected by the SWG concerning the SIRTF . Each of the main areas of study leading to adoption of the Level One Requirements will be briefly described in order to serve as a guide for future use.

In addition to full participation in regularly scheduled SWG and ITWG meetings and tele-conferences special meetings with JPL project personnel provide an important and frequent means of communication.

STUDY OF THE THREE SIRTF INSTRUMENTS

Leading to the current baseline designs of the three SIRTF instruments, IRS, IRAC and MIPS, detailed reviews were conducted. Of particular importance were recommendations concerning the camera fields of view. A common FOV for both the MIPS and IRAC cameras was chosen so that efficient multi-band surveys, mapping and photometric measurements of sources and extended regions can be accomplished. Other changes in the baseline design of the IRAC cameras were made based on study of tradeoffs between sensitivity and resolution at the shortest wavelength.

STUDY OF DETECTORS AND COOLED ELECTRONICS

As described in some detail in the previous progress report it became clear that SIRTF would benefit if a common solution could be found to the generic problems that must be solved to design cooled electronics for use in the focal planes of the three SIRTF instruments. To understand the behavior of a certain class of cryogenic MOSFET amplifiers at the temperatures and noise levels needed to satisfy SIRTF requirements a large scale development project was started. This is a collaborative effort, now known as the Valley Oak project, involving a number of scientists and engineers at several institutions. Coordination of the design and testing of VO devices is a major part of the work performed under this grant during the last year. Frequent reviews of progress have been made to the SWG and updates have been circulated to the SIRTF.VO group and to the Instrument Technology Working Group (ITWG).

STUDY OF THE SIRTF TELESCOPE

To achieve the scientific goals of SIRTF as portrayed to the user community the optical system must perform to certain levels. If the telescope is over designed its cost and risk

factors greatly increase. Thus, a critical set of compromises were made regarding the imaging requirements, the sensitivity requirements and requirements on stray light rejection. It was determined that a 90 percent optical efficiency at 3.0 microns should be the prime determinant in the optical performance requirement of the telescope.

Efforts to derive the optimum primary and final focal ratios for the telescope were begun. Here there are many different conflicting considerations and no specific changes in the long standing baseline design have been adopted. Additional work is required before changes can be made with confidence. However, sufficient reasons to carry out a more detailed analysis have been put forward.

CRYOGENIC SYSTEM

Frequent reviews of the baseline cryogenic system were held and many updates to the thermal model have been studied. In a formal sense the current baseline design satisfies the 5 year lifetime requirement, as deemed necessary for a general purpose facility such as SIRTF. However, many important issues have been identified and discussions with the project at JPL continue on various aspects of the problem. The most important single issue under discussion at present is the mechanical support system. Another issue that has been raised with the project involves tradeoffs between the optical system, as now configured, and the length to diameter ratio of the dewar.

POINTING SYSTEM

Working closely with Fred Gillett the basic pointing and control system for SIRTF has been reviewed a number of times. Here there are critical design concept issues that have not been settled. The role and design of the Cooled Fine Guidance Sensor is of paramount concern. A specific set of recommendations have been made to the project at JPL and they are under consideration. No baseline design has been chosen.